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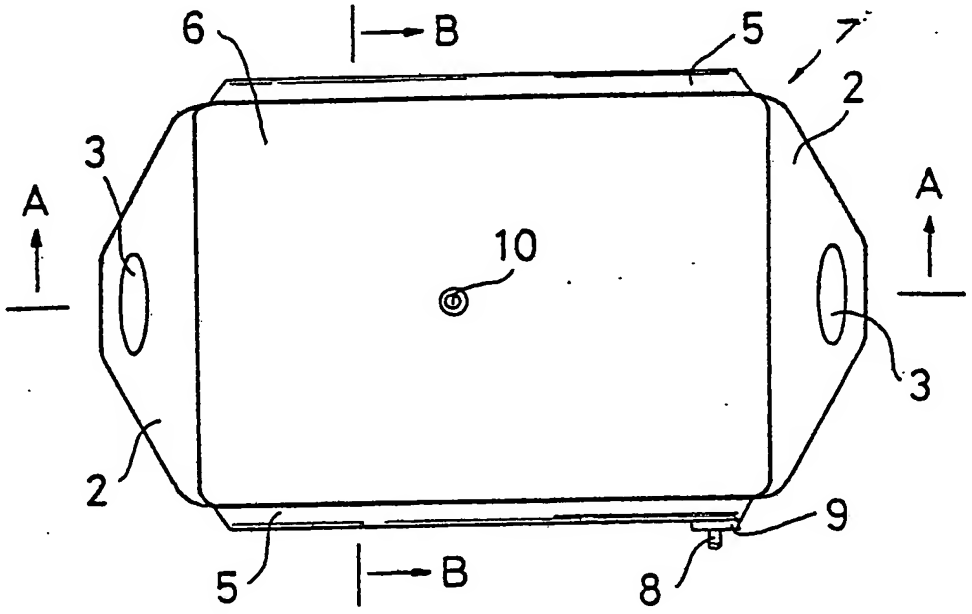

(57) Abstract

Container (7) for the solar heating and storage of liquid, preferably water, intended for use primarily in open-air activities. The container (7) comprises a solar heat-absorbing, comparatively stiff wall (6) of heat conducting material, e.g. rubber, and a comparatively stiff bottom wall (1) of heat insulating material. These walls are connected via side walls (4, 5) which function as bellows, such as to form a container (7), which has a valve (10) for releasing air, whereby the heat-absorbing wall (6) is kept in contact with the liquid with the aid of the collapsibility of the side walls (4, 5) and independent of the degree to which the container (7) is filled. The container (7) may be suitably manufactured entirely from rubber.

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Container for the solar heating and storage of liquid

The present invention relates to a liquid heater and container implemented such as to store liquid and heat it by utilizing solar heat, the container being preferably intended for water heating and storage in activities such as those within the leisure time sector.

In open-air activities, living in tents, camping by car or boat, residence in small sports cottages or the like there are usually very limited facilities for providing water heating, e.g. for washing or hygienic purposes. So far, the only practically usable known methods have consisted in heating water by burning suitable fuel, or utilizing permanent installations at camping sites or the like, where electrically or otherwise heated hot water cisterns are often to be found.

Since the above-mentioned types of open-air activity mostly take place during the summer period, when the probability of sunshine is greatest, and when the angle of incidence of the sun's rays is most favourable, it appears an attractive proposition to attempt to utilize the sun as a heat source.

A number of different types of heating apparatus obtaining their heat from solar energy are already known. However, these apparatuses have generally been designed as permanent installations, which may be mounted on a building roof or the like and which are directly connected to the heating or hot tap water system included in the building. Furthermore, attempts have been made to build large, permanent installations for supplying heat to industrial plants, residential areas and the like.

The solar heating installations so far designed have had

many technical problems, as well as the cost of the produced energy being too high. It is therefore not feasible to apply this older, known technology to the leisure time sector, where the cost aspect and the possibility of easily transporting the installation are of decisive importance.

The present invention thus has the object of providing an apparatus for the solar heating and storing of a liquid, this apparatus being implemented such that for a reasonable price it gives maximum efficiency as well as the facility of being transported easily after the occasions of use.

This object is achieved in accordance with the invention by a container including a solar heat-absorbing wall, and which is characterized in that the solar heat-absorbing wall is a defining wall of the container for the liquid, in that this wall is joined to the remaining walls of the container via yielding or flexible walls, whereby the solar heat-absorbing wall is in contact with the liquid in the container irrespective of the degree of filling of the container and its orientation.

To ensure that the solar heat-absorbing wall is given maximum heat-absorbing ability, its orientation in relation to the incident sun rays is of importance. For this reason the invention is also suitably characterized in that the wall is relatively stiff and approximately flat, at least in an unloaded state. By the inventive subject having these characterizing features, the solar heat-absorbing wall can easily be placed at right angles to the incident sun rays, whereby the absorbtion is kept at a maximum. To ensure that there is complete contact between the liquid in the inventive object, and the solar heat-absorbing wall, even when air can get in during filling, it is also

suitable in accordance with the invention that the solar heat-absorbing wall has a valve for evacuating air after filling the container. The invention is also suitably characterized in that the solar heat-absorbing wall is manufactured substantially from black rubber with a matt exterior. Further advantages are achieved with the inventive subject if it is also given the characterizing features disclosed in claims 5-6.

The invention will now be described in detail, with reference to the accompanying drawings.

Fig. 1 illustrates from above a preferred embodiment of the invention,
Fig. 2 is a cross-section approximately along the section line A - A in Fig. 2 and
Fig. 3 is a section along the line B - B in Fig. 1.

It will be seen from the drawings that the container according to a preferred embodiment of the invention has a rear or lower wall 1, and as apparent from Fig. 1 it may have a projecting portion 2 at either end with a carrying or hanging handle 3. The rear wall 1 is connected to the front or upper wall 6, constituting a solar heat-absorbing wall, via the side walls 4 and 5. As it is described above, the inventive subject may be regarded as an approximately rectangular parallelepipedic container 7 for heating and storing a liquid, preferably water. There is a valve 8 for filling and emptying, which is placed on a projecting portion near of the lower wall 1 of the container. It is also suitable to arrange an exhaust valve 10 in the central area of the wall 6 for air which may have come into the container in connection with filling it.

To meet the purpose required of it in an advantageous manner, it is required that the inventive subject may be

readily transported and handled when it is not in use. Complete contact between the liquid to be heated in the container and the inside of the solar heat-absorbing wall 6 is also desirable. For this purpose it is required in accordance with the invention that these side walls 4 and 5 are manufactured from an easily deformable, flexible or yielding material and that they are formed as for bellows, the walls 5 of the long sides being arranged to curve or deflect outwards as the container is emptied, while the walls 4 of the short sides are arranged for curving or deflecting inwards. Furthermore, it is also suitable in accordance with the invention that both the lower surface 1 and the solar heat-absorbing surface 6 are manufactured from a comparatively stiff material, so that these surfaces may be kept approximately flat, although some deformation may take place in both surfaces to enable the bottom surface 1, for example, to be curved and configurated in conformity with the curve of an automobile roof, a boulder or other similar substructure on which the container 7 is placed during use. In the same way some curvature of the solar heat-absorbing surface 6 must also be tolerated, although this curvature is not desirable per se. In accordance with the invention these properties are afforded in a simple way if the entire container is manufactured from rubber, the side walls 4 and 5 being made from a comparatively thin and easily flexible rubber sheet, while the bottom surface 1 and the solar heat-absorbing surface 6 are manufactured from a comparatively thick and stiff rubber material, which may be reinforced with fabric, fibres, metal wires or the like.

Since the side walls 4 and 5 are formed as bellows, the solar heat-absorbing wall 6 will rest in an approximately flat state on the water contained in the container 7 as the container is emptied, provided that no air gets into the container. Since the tap 8 is placed as illustrated

on the drawing, and has a somewhat small through passage, no air can come in via this passage when the container is emptied. This condition is also further ensured by the weight of the solar heat-absorbing wall itself, which together with the flexibility of the side walls 4 and 5 results in pressure on the water contained in the container.

To avoid that air, which may be in the container before it is filled or which comes into the container during filling, will not collect as an air pocket between the water surface and the inside of the solar heat-absorbing wall 6, the latter suitably has in its central area the above-mentioned exhaust valve, via which the air in the cushion can be released when the container is filled and the valve 8 is closed. Since the air is evacuated in this way when the container is filled, no new air can come in and it is ensured thereby that there is complete contact between the inside of the solar heat-absorbing wall 6 and the water, irrespective of the degree to which the container is filled, and also irrespective of the orientation of the container.

To ensure that as good a solar heat-absorbing effect as possible is obtained, the outside of the solar heat-absorbing wall should be matt black and otherwise implemented such that it as effectively as possible enables the absorbtion of incident heat radiation. Furthermore, the material in the solar heat-absorbing wall should naturally have as good heat conducting ability as possible, which may be achieved, e.g. by allowing the material in this wall to have reinforcement using good heat conducting metals such as aluminium or copper or in that the material is mixed with powder, small particles or a similar filler of such metal. If the solar heat-absorbing wall 6 is to have good heat conducting ability, the opposite can apply to the side walls 4 and 5 and the bottom wall 1 in certain cases. In such cases the side walls 4 and 5 are manufactured from

a thin rubber sheet, possibly with fabric reinforcement, the outside of the sheet being provided with a heat-insulating foamed layer, fibre layer or the like. In the same way, the lower wall 1 should of course also have suitable insulation. In such cases where the sun rays cannot be expected to be incident more or less at right angles to the surface 6, one or all of the side surfaces 4 and 5 may be formed as solar heat-absorbing surfaces manufactured from a material with good heat conducting properties. This implementation makes the container according to the invention less sensitive to orientation relative the sun rays, but may possibly give somewhat deteriorated maximum efficiency.

As an alternative to manufacturing the entire container from rubber or rubber-like plastics material, it is of course possible to conceive solutions where the heat-absorbing wall 6 comprises a metallic plate, preferably of copper or aluminium and to which the side walls 4 and 5 are attached by gluing, folding or some similar method. Even though such an implementation may be perhaps a little more expensive in manufacture, it affords the same advantageous possibility of easy transport demanding slight space. On the other hand, the efficiency should be increased in this way, so that the possibly increased price may be compensated more than well.

As mentioned above, the tap valve 8 is placed on a projecting portion 9 of the bottom wall 1. This projecting portion 9 is, in accordance with the invention, suitably connected to the side wall 5, whereby the valve 8 will project out at an angle when the container 7 is filled, thus making it easily accessible.

The container according to the invention is used in the following manner. In the transport and storage thereof it

is collapsed entirely to a flat package such that the solar heat-absorbing wall 6 and the rear wall 1 are more or less in contact with each other. The entire container 7 may then be stored as a flat slab, which does not need to have a thickness of more than a few centimeters. When the container 7 is filled, only the valve 8 is opened and filled from some suitable tap. As soon as water comes into the container, the flexible side walls 4 and 5 will change shape such as to cause the wall 6 to move away from the wall 1 (the bellows is extended). In a fully filled condition, the container 7 will have the approximate cross section indicated in Fig. 2 and 3, providing that it is lying on a flat substructure.

After filling the container 7, the valve 8 is closed, and the container is placed preferably on a flat substructure, with the exhaust valve 10 upwards. The small quantity of air which there was in the container 7 when filling was started, or which may possibly have got into it during the filling process itself will have now collected under the wall 6, preferably in the area of the exhaust valve 10, when this valve is then opened the air will depart so that satisfactory surface contact is formed between the entire inside of the solar heat-absorbing wall and the water in the container.

In accordance with the invention, filling may also take place without using water under pressure. This is simply achieved by a hose being placed on the valve 8 and the small pressure formed by the head of water in the hose (in the order of magnitude 1 - 1,5 meter) is utilized for filling the container. After the container is filled with water in the manner described above, and any air is evacuated, it is placed on a suitable substructure, e.g. a car roof, a boat deck, the roof of a cottage, caravan or the like, its location being selected such that the

solar heat absorbing surface 6 is oriented at right angles to the incident sun rays as far as possible. By there being satisfactory surface contact between the solar heat-absorbing surface and the water and by the former being implemented for good energy absorption, rapid heating is achieved of the water in the container 7.

The invention may be modified within the scope of the following claims. For example, the container may be given practically any configuration further to the rectangular one illustrated on the drawings. For example, circular, elliptic, quadratic or irregular configurations may be utilized. However, the solar heat-absorbing surface should of course be made as large as possible in relation to the enclosed volume of water, as well as this surface being kept as flat as possible. The side walls 4 and 5 do not need to be folded or flexible in the manner illustrated on the drawings, but may be folded in several folds and also be implemented in the same way along all sides of the container. The air exhaust valve may optionally be placed somewhere else, suitably at a corner of the container, or it may be possibly excluded altogether, providing that the emptying and filling valve 8 is placed so that for a suitable orientation of the container it can function as an air exhaust valve.

CLAIMS

1. Container for the solar heating and storage of liquid, preferably water, intended for use primmarily in open-air activities or similar mobile activities such as living in tents and camping with automobiles or boats, said liquid container (7) having an upwardly directed or upper solar heat-absorbing exposure surface (6) which is large in relation to the volume of the container (7), said container having a height which is small in comparison to its exposure surface (6) and which is also provided with a downwardly directed or lower support surface (1) intended for placing on a suitable substructure, e.g. an automobile roof, a caravan, etc., characterized in that the upper solar heat-absorbing exposure surface comprises a stiff wall (6) of heat conducting material which is substantially flat in an unloaded condition, and in that the lower support surface comprises a similarly stiff wall (1) of preferably heat insulating material, which is flat in an unloaded state, both walls (1,6) being joined together to form the liquid container (7) itself via at least one bellows-shaped and easily foldable side wall (4,5) of a deformable material, whereby the solar heat-absorbing wall (6) is in continuous contact with the liquid in the liquid container (7) due to the yielding property of the side wall (4,5), irrespective of the degree to which the container (7) has been filled, and thus achieving maximum heat absorption capacity and also providing by its own weight a pressure effect on the liquid in the container (7) when the container (7) is being emptied.

2. Container as claimed in claim 1, characterized in that the lower wall (1) of the container (7) contains at least one projecting portion (2) at one end or edge, the portion (2) including a carrying or hanging handle (3).

3. Container as claimed in claim 2 or 3, c h a r a c t e r i z e d i n that the solar heat-absorbing wall (6) has a valve (10) for evacuating air after filling the container (7) via a filling and tapping valve (8) arranged on a projecting portion (9) of the lower wall (1) of the container (7).

4. Container as claimed in any of claims 1 - 3, c h a r a c t e r i z e d i n that the solar heat-absorbing wall (6) is manufactured substantially from black rubber with a matt exterior.

5. Container as claimed in any of the preceding claims, c h a r a c t e r i z e d i n that the yield side wall (4,5) is manufactured substantially from easily flexible rubber.

6. Container as claimed in any of the preceding claims, c h a r a c t e r i z e d i n that the wall (1) opposite the solar heat-absorbing wall (6) is manufactured substantially from rubber and provided with heat insulating material.

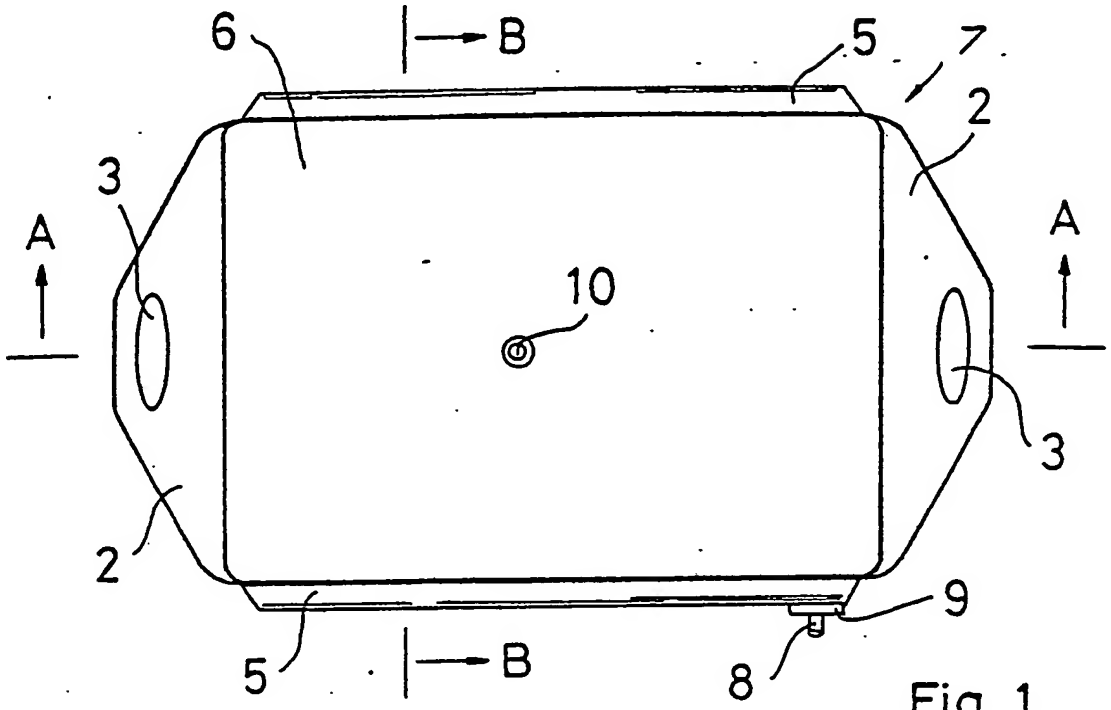

Fig 1

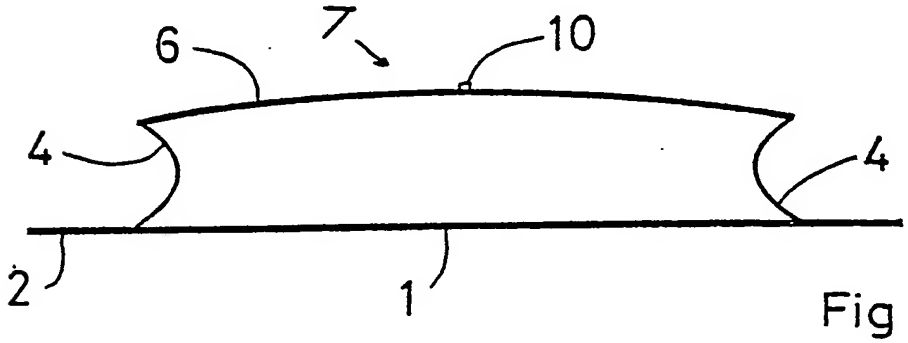

Fig 2

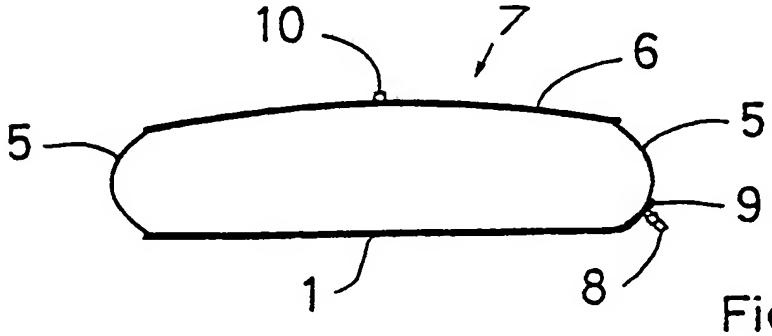

Fig 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE84/00404

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

F 24 J 2/36

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 4	F 24 J 2/00, 2/36
US Cl	126:271, 426

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category [15]	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	DE, . 436 986 (H. KLEINWÄCHTER) 19 February 1976	
A	US, A, 3 029 806 (O. YOSHIMATSU) 17 April 1962	

[15] Special categories of cited documents: [16]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
1985-02-05	1985 -02- 11
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	K. Bengtsson

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